shown in the figures of the specification. Applicants respectfully disagree and point out that Figure 4, for example, clearly shows the hydrogen purifying apparatus wherein two or more reaction segments are connected in parallel. Thus, it is unnecessary to cancel this feature from the claims. Reconsideration and withdrawal of this objection are respectfully requested.

The Examiner has also objected to the Specification. In response, the ABSTRACT OF THE DISCLOSURE section of the specification has been amended to overcome the Examiner's objection based on the alleged use of "legal phraseology." Also, several paragraphs of the DETAILED DESCRIPTION OF THE INVENTION section of the specification have been amended to make mention of reference signs/numbers shown in Figs. 3, 4, 5 and 7. These amendments are consistent with the description in the specification as it relates to Fig. 1, for example, as several of the same structural elements in the embodiment of Fig. 1 also appear in the embodiments of Figs. 3, 4, 5, and 7. The specific changes to the specification appear in the Marked-Up Version of the Specification. No new matter has been added by the amendments to the specification, and entry is respectfully requested.

Rejection Under 35 U.S.C. §102

The Examiner has rejected claims 1, 3-4, 6, 8-14, 21 and 23-26 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,271,916 of Vanderborgh, *et al.* ("Vanderborgh"). The Examiner has also rejected claims 1, 6, 8-9, 11, 21 and 25-26 under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 5,874,051 of Heil, *et al.* ("Heil"). Applicants traverse these rejections with regard to all of the rejected claims. However, Applicants' arguments in support of patentability of the rejected claims are set forth in detail below only with respect to the presently pending claims.

The Examiner asserts that, with respect to claims 1 and 21, Vanderborgh discloses an apparatus comprising: a reaction segment 26 having a catalyst bed 30, 32 (Figs.; col. 6, lns. 25-40); a reformed gas inlet 18 for supplying the reformed gas to the reaction segment 26 via a reformed gas pathway (Figs.; col. 3, lns. 59-67); an oxidant gas supplying segment 60 for supplying oxidant to the reformed gas supply pathway (Figs.; col. 4, ln. 62 to col. 5, ln. 41); a cooler 20 for cooling an upstream side of said catalyst bed 30, 32 (Figs; col. 5, ln. 55 to col. 6, ln. 2); and means 42 for heating a downstream side of said catalyst bed 30, 32, wherein said means 42 is a portion of the reformed gas pathway formed in proximity with said catalyst bed via a partition 46 (Figs., best shown in Fig. 2; col. 8, lns. 41-63). The Examiner also states that Vanderborgh discloses a reformed gas pathway (i.e., at 31) that is at least partially surrounds a catalyst bed 30, 32 (Figs).

Vanderborgh describes an apparatus that comprises a first reaction means 26 and a second reaction means 54 (see claim 16, col. 6, lns. 3-4 and col. 9, lns. 31-32). More specifically, the apparatus comprises: a first oxygen inlet means 60; a first heat exchanger means 20 for adjusting the temperature of a feed stream; a first reaction means 26 in communication with the outlet of the first heat exchanger means 20; a second heat exchanger means 42, having an inlet in communication with the first reaction means 26, for adjusting the temperature of the process stream to a second, higher temperature; a second oxygen inlet means 48 downstream of the first reaction means 26; and a second catalyst-filled reaction means 54 in communication with the outlet of the second heat exchanger means 42 (claim 16; see also Figs. 1-2). In the preferred embodiment, the first reaction means 26 comprises reaction chambers 30, 32 and the second reaction means 54 comprises a second stage reaction chamber 56 having a catalyst therein (col. 6, lns. 8-11 and col. 9, lns. 31-32).

As shown in Fig. 1 of Vanderborgh, the first heat exchanger means 20 includes a housing 22 which provides a reservoir for containing a fluid therein (col. 5, lns. 55-57). Preferably, the reservoir defined by the housing 22 contains a fluid that is a two phase material selected as a liquid that boils at the appropriate temperature (col. 5, lns. 59-62). As previously stated, the first reaction means is in fluid communication with the first heat exchanger means 20 (claim 16). Also, as shown in Fig. 2 of Vanderborgh, preferably, the process stream enters the second heat exchanger assembly 42 through a conduit 44 connected to a housing 46 of the second heat exchanger means 42. The process stream then flows through the housing 46 and preferably in counter-flow arrangement to the feed stream conduit 19 exiting the shift reactor outlet 18. In this manner, the process stream is cooled, but remains at a temperature greater than a first predetermined temperature and the feed stream is simultaneously heated (col. 8, lns. 45-54).

The structural elements of the apparatus of the present application, as recited in claims 1 and 21, are different from the structural elements in Vanderborgh. For example, in contrast to the apparatus in Vanderborgh, the apparatus of the present invention, as shown, e.g., in Fig. 3, comprises a means for heating the downstream side of a catalyst bed which is the reformed gas in a portion of a reformed gas pathway located in proximity to the catalyst bed and separated from the catalyst bed by a wall so as to heat the downstream side of the catalyst bed by the reformed gas before passing through the cooler (see claim 1). In other words, an important structural feature of the present invention, which is not taught by Vanderborgh, is the inclusion of a wall which separates the reformed gas from the catalyst bed as the reformed gas proceeds along the reformed gas pathway.

As shown, e.g., in Fig. 3 of the present invention, the catalyst layer 11 of the present invention is adjacent to and enveloped in close proximity to the reformed gas pathway. This enables the downstream side of the catalyst layer 11 to be heated by the reformed gas. The reformed gas is cooled by passing through a cooler 17 before passing through the catalyst layer 11. As such, a means for heating the downstream side of the catalyst layer 11 is provided by the reformed gas. Use of the reformed gas to heat the catalyst bed is the result of structural elements recited in claims 1 and 21 of the present invention.

Further, it is the structural elements and the arrangement of primarily the cooler 17 and the reaction chamber 18, as recited in claims 1 and 21, that enable the hydrogen purifying apparatus of the present invention to establish a wide and stable temperature profile along the catalyst layer 11. More specifically, the structure of the apparatus enables the formation of a temperature zone or profile such that CO is most efficiently reacted with the catalyst layer (page 15, lns. 26-28). This is true regardless of whether there is a change in the temperature of reformed gas or the cooling medium in the cooler such that these changes would not interfere with the stable removal of CO (page 16, lns. 2-6). Also, since the reformed gas flow pathway thermally insulates the catalyst layer 11, the temperature distribution in the center and the periphery of the catalyst layer 11 becomes homogeneous, thereby enabling efficient oxidation of CO (page 18, lines 7-11). Moreover, because the reformed gas is cooled after passing through the cooler, the temperature of the catalyst layer 11 can be lowered at the upstream side and elevated at the downstream side of the catalyst layer 11 (page 18, lns. 17-20). As a result, the temperature distribution along the catalyst layer 11 can be optimized in response to selective oxidation of CO by the catalyst (page 18, lns. 20-22). These improvements are possible as a

result of structural elements of the claimed invention which are not taught or suggested by Vanderborgh.

For the reasons stated above, Applicants assert that Vanderborgh does not teach or suggest all of the elements recited in claims 1 and 21. Therefore, Applicants respectfully request reconsideration and withdrawal of the §102 rejection as it applies to claims 1 and 21.

With respect to claims 3 and 23, the Examiner asserts that Vanderborgh discloses that an upstream side portion 30, 32 of the catalyst bed is formed of different catalyst material than that of a downstream side portion 56, and that the catalyst constituting the downstream portion exerts and activity at a lower temperature than the catalyst constituting the upstream side portion of the catalyst bed (col. 9, lns. 31-35; col. 9, lns. 53 to col. 10, lns. 25).

As previously stated, Vanderborgh describes an apparatus that comprises a first reaction means 26 and a second, separate, reaction means 54 (see claim 16, col. 6, lns. 3-4 and col. 9, lns. 31-32). As a result, the upstream side reaction chambers 30, 32 are located in a different reaction means from the downstream side or second reaction chamber 56 (see Vanderborgh, Fig. 1).

In contrast, claims 3 and 23 recite a reaction segment having a catalyst bed wherein an upstream side portion of the catalyst bed is formed of different catalyst materials than that of a downstream side portion, and wherein the catalyst materials constituting said downstream side portion exerts an activity at lower temperature than the catalyst materials constituting said upstream side portion (see claims 3 and 23). As such, the apparatus of the present invention includes a catalyst bed with upstream and downstream portions of different catalyst materials in each portion such that the same reactor segment can be formed with different catalyst materials. Thus, the apparatus of the present invention is structurally different

from the apparatus of Vanderborgh which describes two or more reaction means comprising reaction chambers having different catalyst material in the chambers.

Since Vanderborgh does not teach or suggest a reaction segment having upstream and downstream portions of a catalyst bed with different catalyst materials, as recited in claims 3 and 23, Vanderborgh does not anticipate the present invention. Therefore, Applicants respectfully request reconsideration and withdrawal of this §102 rejection..

The Examiner has also rejected claims 4, 6, 8-10 and 24-26 arguing that these claims are anticipated by Vanderborgh. Applicants disagree and rely on their arguments in support of claims 1 and 21 above to which the rejected claims depend either directly or indirectly. As such, claims 4, 6, 8-10 and 24-26 are allowable for at least the same reasons stated above. Therefore, Applicants respectfully request reconsideration and withdrawal of the §102 rejection directed to claims 4, 6, 8-10 and 24-26.

Notwithstanding, in further support of claim 9, Applicants add that, contrary to the Examiner's assertion, the figures of Vanderborgh do not establish that the reaction segment 26 is placed outside the reformed gas pathway 31 or 33. Instead, Fig. 1 of Vanderborgh merely shows that the first reaction means 26 is connected to conduit 31, 33 (see Vanderborgh, Fig. 1). The conduit 31, 33 is necessary because two reaction chambers 30, 32 are used and, as a result, the feed stream must be divided into first and second feed stream branches at a T-fitting 29 connected to the conduit 31, 33 (col. 6, lns. 14-23). This structural feature of Vanderborgh is significantly different from the apparatus recited in claim 9 of the present invention wherein the reaction segment is located outside the reformed gas pathway before passing through said catalyst bed (see, e.g., Fig. 4).

The Examiner also rejected claims 1, 6, 8-9, 11, 21 and 25-26 under § 102(e) based on Heil. With respect to claims 1 and 21, the Examiner asserts that Heil discloses an apparatus (Fig. 2; col. 4, lns. 50 to col. 7, lns. 46) comprising: a reaction segment P_n where $n \geq 1$, having a catalyst bed 5; a reformed gas E inlet 13 for supplying the reformed gas to the reaction segment P_n via a reformed gas pathway (inlet 13, reaction chambers 2, through openings 14a, and exit 14 or l4b); an oxidant gas supplying segment 3 for supplying oxidant to the reformed gas supply pathway; a cooler (W_1 to W_{n-1} employing W_1) for cooling an upstream side of said catalyst bed; and means for heating a downstream side of said catalyst bed (via controlled CO-oxidation along the reaction path), wherein the means is a portion of the reformed gas pathway (i.e., portion 2 within segments P_n) formed in proximity with said catalyst bed 5 via partition P_n so as to heat said catalyst bed 5 by said reformed gas before passing through said cooler W_n. It is also asserted that Heil discloses that the reformed gas pathway (i.e., reaction chamber 2) at least partially surrounds the catalyst bed 5. Further, in response to Applicants' argument in support of claim 1 in the Amendment dated September 23, 2002, the Examiner stated that, Applicants' argument failed to comply with 37 C.F.R. 1.111(b) because it amounted to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references, as the reaction segment, reformed gas pathway, and cooler of Heil meet the language of the claim.

Claim 1 of the present invention describes a hydrogen purifying apparatus for oxidizing and removing carbon monoxide in a reformed gas containing carbon monoxide in addition to a main component of hydrogen gas, comprising a reaction segment having a catalyst bed for oxidizing carbon monoxide, a reformed gas inlet for supplying said reformed gas to said reaction segment via a reformed gas pathway, an oxidant gas supplying segment for supplying an

oxidant gas to said reformed gas pathway, a cooler for cooling an upstream side of said catalyst bed, and means for heating a downstream side of said catalyst bed, wherein said means for heating the downstream side of said catalyst bed is the reformed gas in a portion of a reformed gas pathway located in proximity to said catalyst bed and separated from the catalyst bed by a wall so as to heat said downstream side of said catalyst bed by said reformed gas before passing through said cooler (claim 1). Thus, the language of claim 1, similar to the language of claim 21, establishes the structure of an apparatus for purifying hydrogen which enables a reformed gas to heat the downstream side of a catalyst bed that is located in a reformed gas pathway (see claims 1 and 21).

Claim 1 also recites that the reformed gas pathway and catalyst bed are separated by a wall of the reformed gas pathway. Further, the language of claims 1 and 21 establishes that the reformed gas, located in the reformed gas pathway, heats the downstream side of the catalyst bed before passing through the cooler. Moreover, as previously stated, as a result of the apparatus' structure, the apparatus provides an improved (highly stable and easily controlled) temperature profile which is not taught or suggested by the prior art, including Heil.

In contrast, Heil actively regulates the temperature of the catalyst by the quantity of oxidizing gas that is added to the reaction chamber 2 (col. 6, lns. 50-54) in conjunction with passive cooling that occurs as a result of the mixed gas stream in contact with the outer walls of the reaction chamber 2 (col. 4, lns. 7-11; see also, Figs. 1-2). More specifically, the apparatus in Heil is a CO-oxidation reactor 1 which consists of three oxidation stages marked I, II, and III (Fig. 1, and col. 3, lines 17-18). The mixed gas stream containing hydrogen is supplied to the CO-oxidation reactor 1 in the vicinity of the first oxidation stage I (col. 3, lines 21-23). In the individual oxidation stages I-III, carbon monoxide is reduced in stages by selective oxidation on

suitable catalysts (col. 3, lines 29-31). The oxidizing gas is added to the mixed gas stream through several inlet openings 3 along the CO-oxidation reactor. Thus, Heil does not teach or suggest the structure of the apparatus recited in the language of claims 1 and 21 of the present invention. Moreover, this assertion by Applicants is not merely a "general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims patentably distinguishes them from the references." Instead, Applicants argue that, while Heil may describe a reaction segment, a reformed gas pathway, and a cooler, Heil does not teach of suggest all of the elements of either claim 1 or claim 21 for the reasons set forth above. Therefore, Applicants respectfully request reconsideration and withdrawal of the §102 rejection based on Heil as it pertains to claims 1 and 21.

With respect to claim 6 and 25, the Examiner asserts that Heil (col. 3, lns. 28-38; col. 6, lns. 39-51; col. 7, lns. 18-23) discloses a gas flow rate control valve 4 to regulate or control the addition of oxidizing gas in correspondence with a temperature of said catalyst bed. The Examiner also responds to Applicants argument in the September 23, 2002 Amendment by stating that Applicants have recited an intended use of the claimed invention without establishing a structural difference between the claimed invention and the prior art. Applicants disagree.

As Applicants stated in their September 23, 2002 Amendment, the valve in Heil is a metering device 4. Conversely, the valve described in the present invention is an air flow rate control valve 4. The metering device 4 is structurally different from the air flow rate control valve 4 of the present invention. The differences between the valves are best understood by explaining their capabilities and limitations. The metering devices 4 in Heil located at each of the inlet openings 3 regulate or control the addition of oxidizing gas. Also, Heil is interpreted to

teach that the metering devices 4 are the primary means by which the apparatus in Heil controls temperature in the reactor ". . . to achieve practically any desired temperature profile along the flow path of the reaction gas mixture." (col. 6, lns. 55-57). In contrast, the air flow rate control valve 4 of the present invention is capable of supplying an air volume to the apparatus such that oxygen is regulated at one to threefold volume ratio with carbon monoxide (page 15, lns. 1-4). Thus, unlike the metering devices 4 in Heil, the air flow rate control valve 4 is capable of establishing the oxygen to carbon monoxide volume ratio as the reformed gas enters the catalyst layer 1. Reconsideration and withdrawal of the §102 rejection of claims 6 and 25 are respectfully requested.

With respect to claim 8 and 26, the Examiner asserts that Heil (Fig. 2; col. 4, lns. 66 to col. 5, lns. 12) discloses that the reformed gas flows in a first direction (through inlet 13, by arrow E) prior to passing through the cooler W_1, and passes through the catalyst layer 5 in a second direction (through outlet 14, by arrow P_e), wherein the first and second directions are opposing. Also, in response to the Applicants' argument in the September 23, 2002 Amendment, the Examiner argues that, with respect to claim 8, Heil teaches structural features that enable the mixed gas to flow in a first direction and subsequently a second opposing direction, as illustrated in Fig. 2. The Examiner asserts that in the embodiment of Fig. 2, the apparatus comprises a hole 13 for conducting an educt gas stream Ė through the reformed gas pathway in a first direction and further comprises a gas outlet 14, from which the product gas stream Pė exits, flowing in an opposing direction to the first direction (col. 4, ln. 50 to col. 5, ln. 12).

Figure 1 of Heil shows an apparatus in which a reformed gas may pass through a series of structures that include a reaction chamber 2, static mixing structures 8, and catalyst support units 5 all in the same direction as a coolant which passes through a cooling chamber 6.

The structural features of the apparatus of Heil do not enable the mixed gas and the coolant to flow in opposite directions nor is it possible for the reformed gas to flow in a first direction prior to passing through the catalyst support units in a second direction. Instead, as shown in Fig. 2 of Heil and as explained in the specification, Heil discloses a CO-oxidation reactor 1 wherein a hole 13 is provided in an upper area as an inlet for an educt gas stream E and a product gas outlet 14 (col. 2, lns. 50-67). The front plate 11 has an inlet 15 in its upper area, through which a flow W_t of a heat-carrying medium is introduced into the reactor at the front and removed again at the front as well, through the outlet 16 in its lower area (col. 5, lns. 8-12). That is, the heat carrying medium W_t passes through openings 15a in the reactor modules P_1 to P_n, and into chambers or areas W_1 to W_{n-1}. Thus, Figs. 1 and 2 of Heil make clear that the reformed gas and the cooling medium flow in the <u>same</u> and not opposing directions. As a result, Heil does not disclose a reformed gas that flows in a first direction prior to passing through a cooler and which passes through the catalyst layer 5 in a second direction, wherein the first and second directions are opposing. Thus, the present invention, as recited in claims 8 and 26, can be patentably distinguished from the prior art based on structure, not just the intended use of the invention. As such, reconsideration and withdrawal of the Examiner's §102 rejection of claims 8 and 26 are respectfully requested.

With respect to claim 9, the Examiner asserts that Heil (Fig. 2) discloses that the reaction segment P_n where $n \geq 1$ is placed outside (i.e. surrounding) the reformed gas pathway. The Examiner restated this assertion in response to the Applicants' argument in support of claim 9 in the September 23, 2002 Amendment. Similarly, the Examiner states that Fig. 2 of Heil discloses a reaction segment P_n, where $n \geq 1$, placed outside (i.e. surrounding) the reformed gas pathway (defined as inlet 13. reaction chambers 2, through openings 14a, and exit 14 or 14b).

Claim 9 recites that the reaction segment is located outside the reformed gas pathway (claim 9). This structural embodiment is clearly shown, for example, in Figure 4 of the application. This embodiment enables the reformed gas to heat the downstream side of the catalyst layer 21 while the reformed gas is simultaneously being cooled (page 19, lns. 23-25). Further, the structure of this embodiment, whereby heat is radiated from the periphery of the reaction segment, minimizes elevation of the temperature in the catalyst layer 21 enabling the apparatus to more easily adjust to increases in load caused by increased flow of the reformed gas (page 19, ln. 29 to page 20, ln. 3).

Contrary to the Examiner's assertion, Heil does not disclose a reaction segment located outside of the flow pathway. Instead, Heil discloses a reaction chamber 2 with static mixing chambers 8 and catalyst support units such that the mixed gas stream contacts the outside walls of the reaction chamber 2 (col. 4, lns. 9-10; see also, Fig. 1). Unlike the present invention, the reformed gas does not initially heat the downstream side of the catalyst layer before passing a heat exchanger and then a reaction segment. Also, in contrast to the present invention, Heil discloses reaction segments P_n that are integral with and, as the Examiner describes, surround the reformed gas pathway. This structure is significantly different from the hydrogen purifying apparatus where the reaction segment is located outside the reformed gas pathway (claim 9; also compare, e.g., Fig. 2 of Heil and Fig. 4 of the present invention). Having established that Heil does not teach or suggest a reaction segment which is located outside the reformed gas pathway, reconsideration and withdrawal of the rejection of claim 9 is respectfully requested.

The Examiner has also rejected claim 11 as being anticipated by Heil. The Examiner contends that it is unclear as to the structural relationship of the second (or plurality) of

reaction segments to the other elements of the apparatus. Applicants traverse this rejection and argue that while the claims establish the metes and bounds of the invention, the specification, including the figures, should be examined to better understand the metes and bounds of the claims. While not necessarily limited to the embodiments shown in the figures, Figure 4 clearly shows an example wherein the hydrogen purifying apparatus comprises two or more reaction segments connected in parallel. Thus, it is not unclear as to the structural relationship of the second (or plurality) of reaction segments to the other elements of the apparatus. Accordingly, reconsideration and withdrawal of the rejection of claim 11 is respectfully requested.

Rejection Under 35 U.S.C. §103

The Examiner has rejected claims 15 and 19 under 35 U.S.C. §103(a) as being unpatentable (obvious) over Vanderborgh. The Examiner has also rejected claim 16 under §103(a) as being obvious over Vanderborgh in view of U.S. Patent No. 3,785,781 of Hervert, *et al.* ("Hervert"). Further, the Examiner has rejected claim 17 under §103(a) as being obvious over Vanderborgh in view of Heil. Moreover, the Examiner has rejected claims 20 and 22 under §103(a) as being obvious over Vanderborgh in view of U.S. Patent No. 6,029,443 of Hirota, *et al.* ("Hirota"). Applicants traverse these rejections; however, because these rejected claims have been cancelled in this amendment without prejudice to the filing of a divisional application, no argument in response to these rejections is provided herein.

CONCLUSION

Based on the foregoing amendments and remarks, Applicants respectively submit that the claimed invention for a hydrogen purifying apparatus is patentably distinguishable over the cited prior art. Reconsideration and withdrawal of the Examiner's rejections of the claims and a Notice of Allowance are respectfully submitted.

REQUEST FOR INTERVIEW

In the event that the Examiner does not now believe the application to be in condition for allowance, Applicants respectfully request an interview with the Examiner to further discuss what amendments may be necessary for allowance of the claims. Applicants, by and through their undersigned counsel, will contact the Examiner in approximately one month to inquire as to whether it is necessary to schedule an interview with the Examiner.

Respectfully submitted,

KIYOSHI TAGUCHI *ET AL*

3/27/03 By: Will C. Youngblood

(Date)

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Enclosures

Marked-Up Version of the Specification

Page 53:

- -ABSTRACT OF THE DISCLOSURE

A [The present invention relates to a] hydrogen purifying apparatus is provided for oxidizing and removing carbon monoxide (CO) in a reformed gas containing CO in addition to a main component of hydrogen gas[,]. The apparatus has [comprising] a reaction segment [having] with a catalyst layer for oxidizing CO, a reformed gas supplying segment for supplying the reformed gas to the reaction segment via a reformed gas supply pathway, and an oxidant gas supplying segment for supplying an oxidant gas on the path of the reformed gas supply pathway. Preferably, the apparatus [comprises means for cooling] cools the catalyst layer at the upstream side and [means for heating] heats the catalyst layer at the downstream side.- -

Under Embodiment 1-2 at page 19:

- -The hydrogen purifying apparatus of Embodiment 1-2 in accordance with the present invention will be described herein. As shown in FIG. 3, a hydrogen purifying apparatus in accordance with the present embodiment comprises a honeycomb catalyst layer 11 formed inside a tube-shaped reaction chamber 18, a reformed gas inlet 12, an air supply duct 13, an air flow rate control valve 14, a supply duct 15, a volume control valve 16, a reformed gas flow pathway formed external to the reaction chamber 18, a reformed gas outlet 19, and a heat exchange fin 20 provided on a wall of the reformed gas flow pathway neighboring the downstream side of the catalyst layer 11. The operation and effect of the apparatus of this

embodiment are mostly similar to those of the apparatus of Embodiment 1-1. Therefore, the description of this embodiment will be focused on different features from those of Embodiment 1-1.- -

Under Embodiment 1-3 at page 19:

- -The hydrogen purifying apparatus of Embodiment 1-3 in accordance with the present invention will be described herein. As shown in FIG. 4, the hydrogen purifying apparatus in accordance with the present embodiment comprises a reformed gas inlet 22, an air supply duct 23, an air flow rate control valve 24, a supply duct 25, a volume control valve 26, a reaction chamber 28 formed on the periphery of a tube-shaped reformed gas flow pathway, a honeycomb catalyst layer 21 formed inside the reaction chamber 28, a reformed gas outlet 29, and a heat exchange fin 30 provided on a wall of the reformed gas flow pathway neighboring the downstream side of the catalyst layer 21. The operation and effect of the apparatus of this embodiment are mostly similar to those of the apparatus of Embodiment 1-2. Therefore, the description of this embodiment will be focused on different features from those of Embodiment 1-2.- -

Under Embodiment 1-4 at page 20:

--The hydrogen purifying apparatus of Embodiment 1-4 in accordance with the present invention will be described herein. As shown in FIG. 5, the hydrogen purifying apparatus in accordance with the present embodiment comprises a honeycomb first catalyst layer 31 formed inside a reaction chamber 40, [and] a second catalyst layer 32 formed downstream from the first catalyst layer 31, a reformed gas inlet 33, an air supply duct 34, an air flow rate control valve 35,

a supply duct 36, a volume control valve 37, a heat exchanger 38, a heater 39, and a reformed gas outlet 41. The operation and effect of the apparatus of this embodiment are mostly similar to those of the apparatus of Embodiment 1. Therefore, the description of this embodiment will be focused on different features from those of Embodiment 1.- -

Under Embodiment 1-5 at page 22:

- -The hydrogen purifying apparatus of Embodiment 1-5 in accordance with the present invention will be described herein. As shown in FIG. 7, the hydrogen purifying apparatus in accordance with the present embodiment comprises a honeycomb first catalyst layer 51, [and] a second catalyst layer 52 formed downstream from the first catalyst layer 51 which are formed inside a reaction chamber 62, a reformed gas inlet 53, a first air supply duct 54, a first air flow rate control valve 56, a second air supply duct 55, and a second air flow rate control valve 57, wherein [a] the second air supply duct 55 is provided between the first and second catalyst layers 51 and 52, a supply duct 58, a volume control valve 59, and a reformed gas outlet 63. The operation in effect of the apparatus of this embodiment are mostly similar to those of the apparatus of Embodiment 1. Therefore, the description of this embodiment will be focused on different features from those of Embodiment 1.- -

Marked-Up Version of the Claims

--1. (Four Times Amended) A hydrogen purifying apparatus for oxidizing and removing carbon monoxide in a reformed gas containing carbon monoxide in addition to a main component of hydrogen gas, comprising a reaction segment having a catalyst bed for oxidizing carbon monoxide, a reformed gas inlet and a reformed gas pathway for supplying said reformed gas to said reaction segment [via a reformed gas pathway], an oxidant gas supplying segment for supplying an oxidant gas to [said] reformed gas pathway, a cooler for cooling an upstream side of said catalyst bed, and means for heating a downstream side of said catalyst bed,

wherein said means for heating the downstream side of said catalyst bed is the reformed gas in a portion of the reformed gas pathway [formed] located in proximity [with] to said catalyst bed and separated from the catalyst bed by a wall [via a partition] so as to heat said downstream side of said catalyst bed by said reformed gas before passing through said cooler.

3. (Three Times Amended) The hydrogen purifying apparatus in accordance with claim 1, wherein an upstream side portion of the catalyst bed is formed of different catalyst material[s] than that of a downstream side portion, and the catalyst material constituting said downstream side portion exerts an activity at lower temperature than the catalyst material constituting said upstream side portion.

4. (Amended) The hydrogen purifying apparatus in accordance with claim 3, wherein at least a portion of said catalyst material in said upstream and downstream sides of the catalyst bed is supported by a metallic material.

6. (Twice Amended) The hydrogen purifying apparatus in accordance with claim 1, further comprising a gas flow rate control valve located on the oxidant gas supplying

segment [capable of] for changing an amount of oxidant gas to be supplied in correspondence with a temperature of said catalyst bed.

8. (Four Times Amended) The hydrogen purifying apparatus in accordance with claim 1, wherein said reformed gas pathway [flows in] has a first direction prior to passing through said cooler, and [passes through said catalyst layer in] a second direction passing through said catalyst bed, wherein the first direction and second direction are opposing.

9. (Twice Amended) The hydrogen purifying apparatus in accordance with claim 1, wherein said reaction segment is [placed] located outside the reformed gas pathway [before passing through said catalyst bed].

10. (Twice Amended) The hydrogen purifying apparatus in accordance with claim 1, wherein said reaction segment is tube-shaped and said [flow] reformed gas pathway [of said reformed gas] before the passage through said cooler is formed around said reaction segment.

21. (Amended) A hydrogen purifying apparatus for oxidizing and removing carbon monoxide in a reformed gas containing carbon monoxide in addition to a main component of hydrogen gas, comprising a reaction segment having a catalyst bed for oxidizing carbon monoxide, a reformed gas inlet and a reformed gas pathway for supplying said reformed gas to said reaction segment [via a reformed gas pathway], an oxidant gas supplying segment for supplying an oxidant gas to said reformed gas pathway, a cooler for cooling said reformed gas in said reformed gas pathway in a vicinity of an upstream side of said catalyst bed, and means for heating a downstream side of said catalyst bed,

wherein said reformed gas pathway at least partially surrounds said catalyst bed, such that said means for heating said downstream side of said catalyst bed comprises at least a

portion of said reformed gas in said reformed gas pathway and such that said reformed gas is cooled in said reformed gas pathway by said catalyst bed before passing through said cooler.

23. (Amended) The hydrogen purifying apparatus in accordance with claim 21, wherein an upstream side portion of the catalyst bed is formed of different catalyst material[s] than that of a downstream side portion, and the catalyst material constituting said downstream side portion exerts an activity at lower temperature than the catalyst material constituting said upstream side portion.

24. (Amended) The hydrogen purifying apparatus in accordance with claim 23, wherein at least a portion of said catalyst material in said upstream and downstream sides of the catalyst bed is supported by a metallic material.

25. (Amended) The hydrogen purifying apparatus in accordance with claim 21, further comprising a gas flow rate control valve [capable of] for changing an amount of oxidant gas to be supplied in correspondence with a temperature of said catalyst bed.

26. (Amended) The hydrogen purifying apparatus in accordance with claim 21, wherein said reformed gas [flows in] has a first direction prior to passing through said cooler, and [passes through said catalyst layer in] a second direction after passing through said catalyst bed, wherein the first direction and second direction are opposing.--